

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-47

Name: Shadehill Reservoir

County: Perkins

Legal description: Sec. 1-4,8-10,15-17,20-23,26,27,34,35; T 21N, R 15E

Location from nearest town: 12 miles south of Lemmon, SD

Dates of present survey: June 9-11, August 14, 18-20, 2014

Date last surveyed: May 28-30, August 8, 12-14, 2013

Management classification: Warmwater permanent

Primary Species: (game and forage)

1. Walleye
2. Smallmouth bass
3. Channel catfish
4. Black crappie
5. Yellow perch
6. Emerald shiner
7. Gizzard shad
8. _____

Secondary and other species:

1. Northern pike
2. Bluegill
3. White bass
4. Spottail shiner
5. Common carp
6. River carpsucker
7. Northern redhorse
8. White sucker

PHYSICAL CHARACTERISTICS

Surface Area: 4,693 acres

Watershed: 2,176,000 acres

Maximum depth: 62 feet

Mean depth: 21.8 feet

Lake elevation at survey (from known benchmark): unknown

Ownership of lake and adjacent lakeshore property:

Shadehill Reservoir is maintained and operated by the United States Bureau of Reclamation. The South Dakota Department of Game, Fish and Parks Department maintains a recreation area/campground and Game Production Area along much of the shoreline.

Fishing Access

Shadehill Reservoir has excellent fishing access for shore and boat anglers alike. Shadehill State Park has four public boat ramps. Many two-track trails around the lake offer the shore angler good access to the water's edge when conditions are dry.

Observations of Water Quality and aquatic vegetation

Due in part to its contour and yearly water level fluctuations, Shadehill Reservoir has limited emergent and submergent vegetation. The lake refilled in 2009 and flooded a ring of vegetation around the lake that was a result of drought during a couple previous years.

Observations on conditions of structures (i.e. spillway, boat ramps and docks, roads, etc)

All access and regulatory structures are in excellent condition. A state park at the reservoir provides excellent facilities for visitors to Shadehill Reservoir.

MANAGEMENT OBJECTIVES

Objective 1. Maintain a walleye fishery with a minimum gill-net CPUE for stock-length and longer walleye of 15, a PSD range of 30-60, a PSD-P greater than 5.

Objective 2. Maintain the gizzard shad population through adult stockings.

BIOLOGICAL DATA

Sampling Effort and Catch

Ten modified fyke (trap) nets and five experimental gill nets were used during 2014 to sample the adult fish population (Figure 1). Trap nets were used from June 9-11 2014 and caught 14 species of fish, totaling 168 fish (Table 1). Gill nets were set August 18-20, 2014 and caught 295 fish (Table 2). Day electrofishing was also completed on August 14, 2014 to index gizzard shad reproduction. Discussion on selected fish species follows and completes this report.

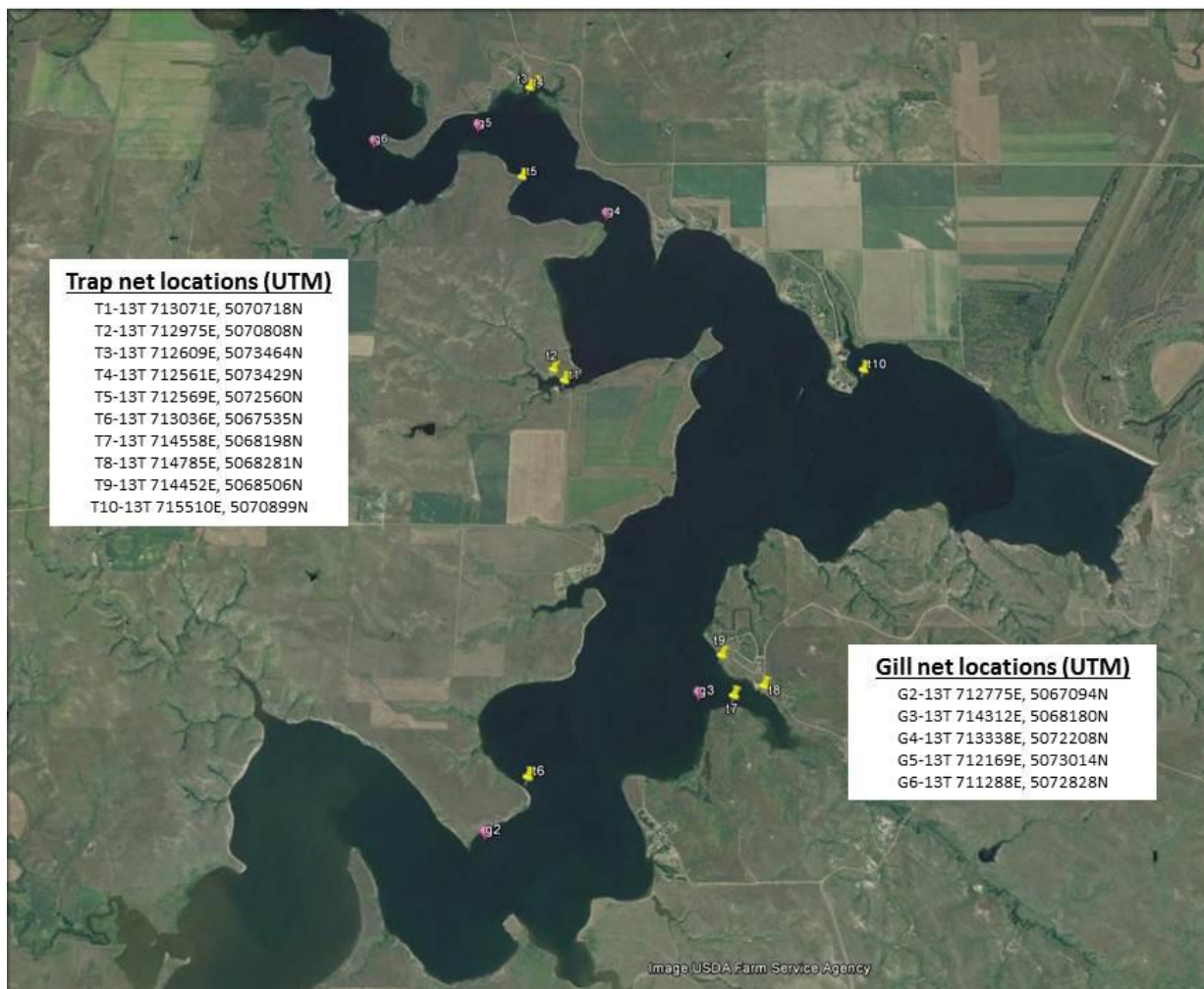


Figure 1. Locations, including GPS coordinates, for trap (T) and experimental gill (G) nets set during the fisheries survey of Shadehill Reservoir, Perkins County, South Dakota, 2014.

Table 1. Catch data from all species collected in ten trap nets in Shadehill Reservoir, Perkins County, South Dakota, June 9-11, 2014. CPUE's with 80% confidence intervals in parentheses. PSD, PSD-P and *Wr* with 90% confidence intervals in parentheses.

Species	N	CPUE	CPUE-S	PSD	PSD-P	<i>Wr</i> >S
Black bullhead	2	0.2 (0.3)	0.2 (0.3)	--	--	86.7 (--)
Black crappie	17	1.7 (0.9)	1.7 (0.9)	100	100	95.5 (1.9)
Bluegill	24	2.4 (1.8)	2.4 (1.8)	4 (7)	0	114.9 (1.7)
Channel catfish	40	4.0 (5.1)	4.0 (5.1)	37 (14)	0	90.3 (0.2)
Common carp	6	0.6 (0.4)	0.6 (0.4)	--	--	85.8 (10.7)
Freshwater drum	1	0.1 (0.1)	0.1 (0.1)	--	--	110.1 (--)
River carpsucker	41	4.1 (2.6)	4.1 (2.6)	100	98 (5)	--
Shorthead redhorse	7	0.7 (0.5)	0.7 (0.5)	--	--	86.8 (3.5)
Smallmouth bass	3	0.3 (0.2)	0.2 (0.2)	--	--	93.0 (6.1)
Walleye	5	0.5 (0.4)	0.5 (0.4)	80 (43)	0	87.8 (8.5)
White bass	1	0.1 (0.1)	0.1 (0.1)	--	--	83.7 (--)
White crappie	17	1.7 (0.7)	1.7 (0.7)	100	100	96.4 (0.7)
White sucker	1	0.1 (0.1)	0.1 (0.1)	--	--	82.6 (--)
Yellow perch	3	0.3 (0.4)	0.3 (0.4)	--	--	92.8 (1.3)

Table 2. Catch data from all species collected in six gill nets in Shadehill Reservoir, Perkins County, August 18-20, 2014. CPUE's with 80% confidence intervals in parentheses. PSD, PSD-P and *Wr* with 90% confidence intervals in parentheses.

Species	N	CPUE	CPUE-S	PSD	PSD-P	<i>Wr</i> >S
Black crappie	16	2.7 (1.1)	1.8 (1.2)	91 (17)	91 (17)	115.9 (8.7)
Bluegill	1	0.2 (0.2)	0.2 (0.2)	--	--	128.0 (--)
Channel catfish	139	23.2 (8.3)	21.3 (7.8)	55 (8)	0	82.4 (0.7)
Common carp	14	2.3 (1.2)	2.2 (1.0)	77 (22)	23 (22)	93.4 (6.7)
Freshwater drum	7	1.1 (0.9)	0.8 (0.7)	--	--	103.5 (2.3)
Gizzard shad	4	0.7 (1.0)	0.0	--	--	--
Goldeye	2	0.3 (0.5)	--	--	--	--
Northern pike	4	0.7 (0.3)	0.7 (0.3)	--	--	78.9 (14.0)
River carpsucker	5	0.8 (0.6)	0.8 (0.6)	--	--	93.8 (4.8)
Shorthead redhorse	39	6.5 (2.9)	6.5 (2.9)	97 (4)	59 (13)	87.7 (1.0)
Smallmouth bass	1	0.2 (0.2)	0.2 (0.2)	--	--	96.1 (--)
Walleye	47	7.8 (3.5)	7.7 (3.3)	74 (11)	4 (5)	80.4 (1.1)
White bass	62	10.3 (4.6)	9.8 (4.3)	58 (11)	44 (11)	92.8 (0.6)
White crappie	2	0.3 (0.3)	0.2 (0.2)	--	--	91.2 (--)
Yellow perch	35	5.8 (2.9)	5.7 (2.9)	65 (14)	6 (7)	95.6 (1.0)

Black crappie

In 2013, catch per unit effort (CPUE) was 75.3 with a PSD of 99 and a PSD-P of 2 (Table 3). This year numbers were much lower with a CPUE of only 1.7. Net locations can vary year to year due to fluctuating water levels at this reservoir and likely influence catch rates. Differences this year, however, may be a result of timing. Due to other spring work, sampling was two weeks later than last year and the fish appeared to be done spawning. Black crappies are surveyed annually and future catch will help determine if the population is truly experiencing a large decline.

Table 3. Data for black crappie collected from trap nets in Shadehill Reservoir, Perkins County, 2011-2013. CPUE listed with 80% confidence intervals in parentheses. PSD, PSD-P and $W_{r>S}$ listed with 90% confidence intervals in parentheses.

Year	N	CPUE	PSD	PSD-P	$W_{r>S}$
2011	69	6.9 (6.6)	97 (3)	41 (10)	106.9 (1.9)
2012	357	44.6 (18.9)	97 (2)	12 (3)	108.6 (1.0)
2013	678	75.3 (38.9)	99 (1)	2 (1)	97.9 (1.1)
2014	17	1.7 (0.9)	100	100	95.5 (1.9)

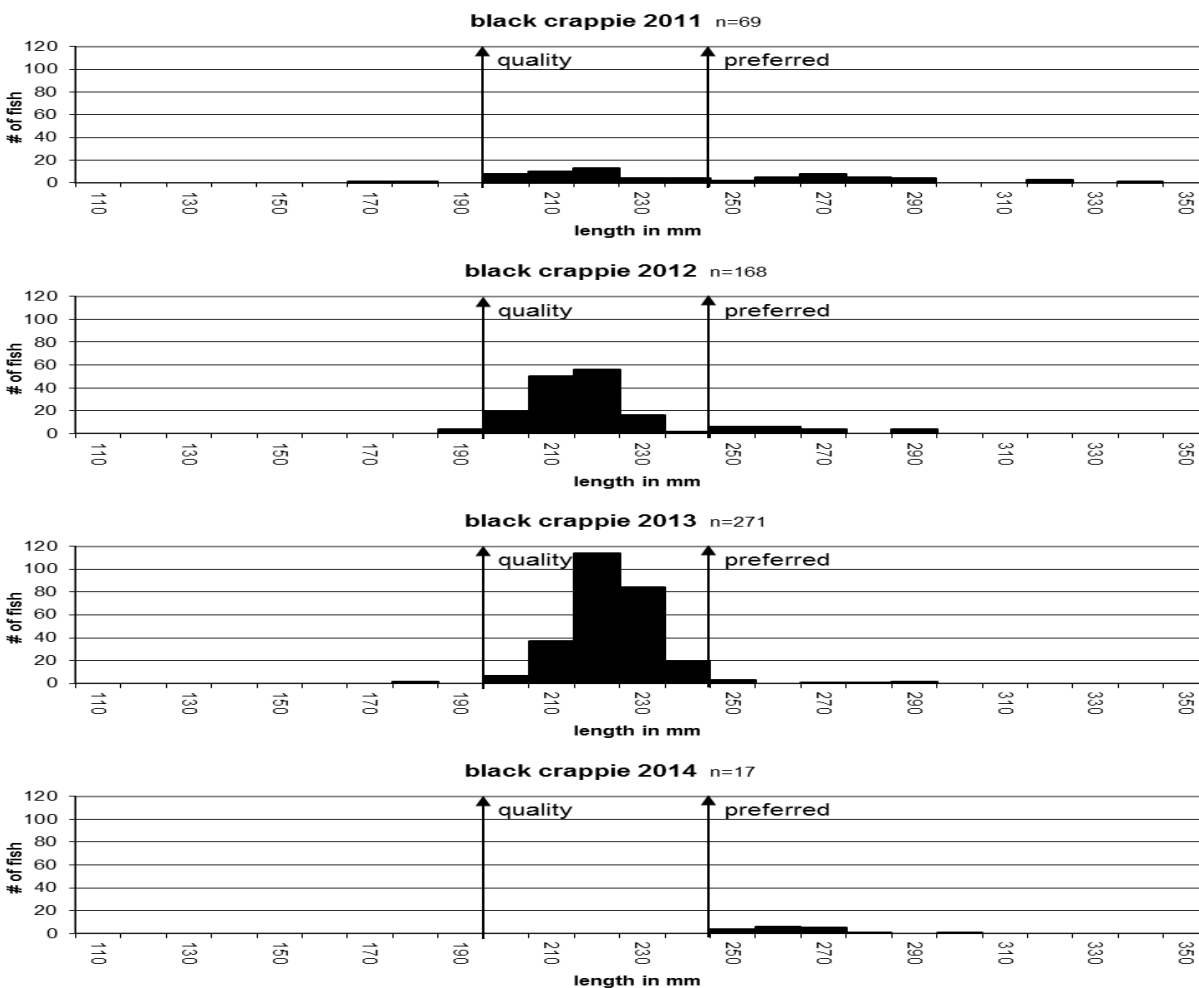


Figure 2. Length frequency histograms for black crappie sampled in trap nets in Shadehill Reservoir, Perkins County, South Dakota, 2011-2014.

Channel catfish

Channel catfish numbers increased with a gill net CPUE of 23.2, compared to 15.4 in 2013 (Tables 2 and 4). Size structure remained similar with a PSD of 55 this year, compared to 53 last year. Proportional stock density of preferred-length fish (PSD-P) has been zero or one for the last nine years. Very few of these abundant channel catfish appear to ever reach larger preferred sizes, or possibly, our gear does not sample the larger fish (Figure 3). Fish condition of adults ($Wr>S$) continues to be below average at 82.4 (Table 4).

Table 4. Data for channel catfish collected by gill nets in Shadehill Reservoir, Perkins County 2006-2014. CPUE's listed with 80% confidence intervals in parentheses. PSD, PSD-P and Wr listed with 90% confidence intervals in parentheses.

Year	N	CPUE	PSD	PSD-P	$Wr>S$
2006	199	24.9 (6.6)	36 (6)	0	78.9 (0.7)
2007	116	19.3 (4.0)	38 (8)	1 (1)	76.5 (0.7)
2008	196	32.7 (9.7)	26 (5)	1 (--)	75.1 (0.8)
2009	29	4.8 (1.4)	41 (16)	0	97.1 (3.5)
2010	81	13.5 (4.9)	67 (9)	0	82.6 (0.2)
2011	137	22.8 (7.9)	71 (7)	1 (1)	88.8 (3.4)
2012	128	21.3 (5.8)	56 (8)	0	84.7 (0.7)
2013	77	15.4 (4.4)	53 (10)	1 (3)	86.2 (0.7)
2014	139	23.2 (8.3)	55 (8)	0	82.4 (0.7)

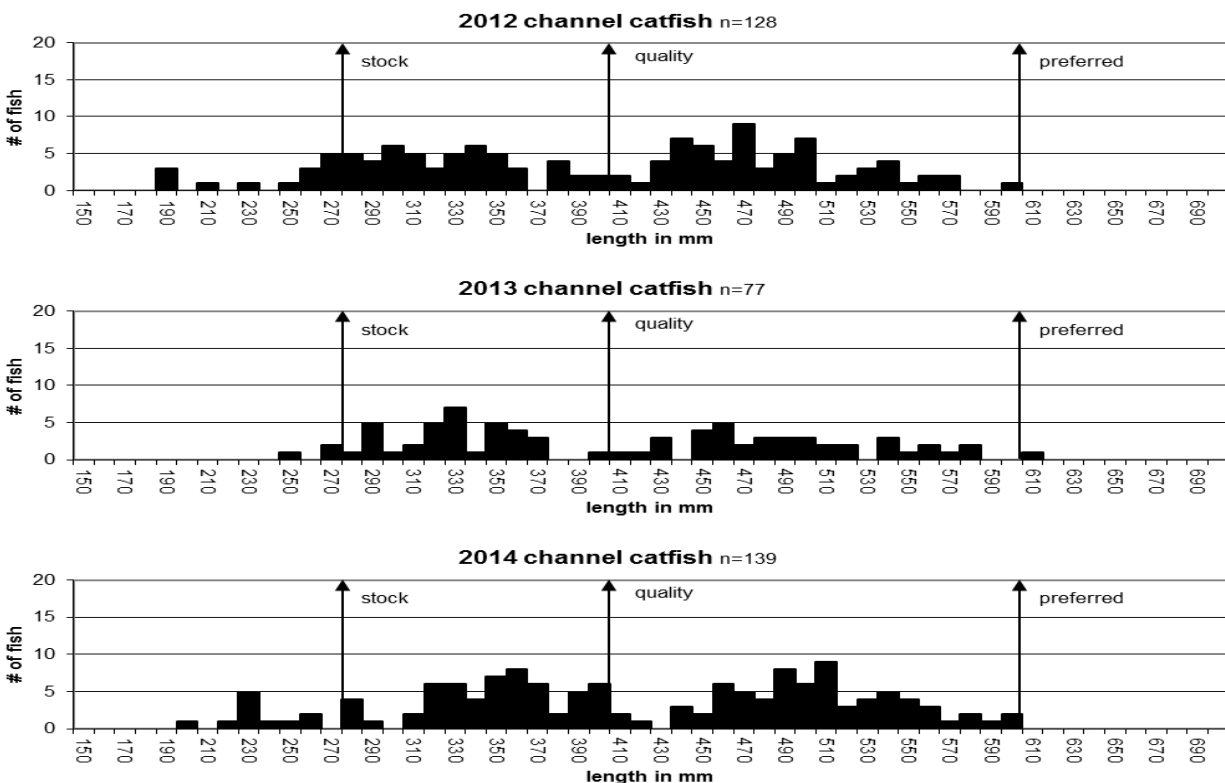


Figure 3. Length frequency histograms for channel catfish sampled in experimental gill nets in Shadehill Reservoir, Perkins County, South Dakota, 2010-2014.

Gizzard shad

Age-0 gizzard shad numbers were down from last year with an electrofishing CPUE of 261 per hour (Figure 4). Five of the ten sites produced shad. The adult gizzard shad population also appeared down with no adult shad sampled in the gill nets, while last year's sampled produced 3.6 per net last year, the highest ever recorded. Three hundred and seventy three adult shad were stocked this year, so the lack of adults in our survey and low number of age-0 shad suggests the winter of 2013/2014 was difficult for shad and many did not survive.

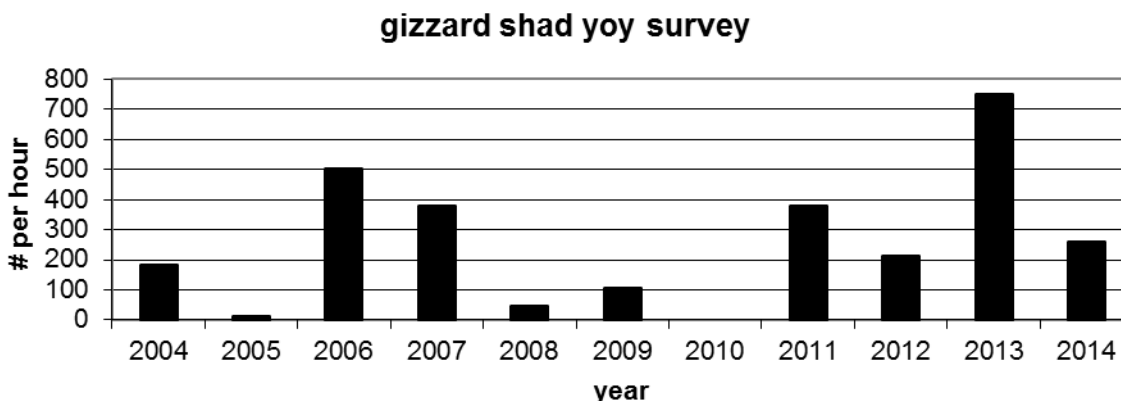


Figure 4. Number of age-0 gizzard shad caught per hour during daytime boat electrofishing surveys from Shadehill Reservoir, Perkins County, South Dakota, 2004-2014.

Walleye

Walleye showed a decrease in abundance this year. Gill net CPUE was 7.8, compared to 25.8 in 2013 (Table 5). Catch for stock length and larger fish also showed a decrease with CPUE going from 25.4 to 7.7, which is well below the management objective of 15. Size structure PSD was 74, a large improvement from 21 last year, and above the management objective of 30-60. The large year class from 2009 surpassed the protected length limit of 15 inches (Table 6 and Figure 5). Walleye condition was again low with a mean $W_{r>S}$ of 80.4. Growth appeared good for the age-5 year class with the average fish of 430 mm versus last year when this year class averaged 349 mm (Tables 7 and 8).

The 2009 year class should provide good fishing for the next year or two, but the apparent lack of younger fish is concerning. The 2009 year class was an outstanding one, likely resulting from flooding in Spring of 2009; however, it appears this year class may have suppressed subsequent year classes. In addition, while fingerling stockings occur nearly annually, fry were stocked in 2012 and 2014 which may also be influencing the number of younger fish observed.

Table 5. Composite listing of data for walleye collected by gill nets in Shadehill Reservoir, Perkins County, 2006-2014. CPUE's with 80% confidence intervals in parentheses. PSD, PSD-P and $W/r>S$ with 90% confidence intervals in parentheses.

Year	N	CPUE	CPUE-S	PSD	PSD-P	$W/r>S$
2006	57	7.1 (1.8)	6.1 (1.7)	27(10)	4 (5)	84.0 (1.0)
2007	56	9.3 (2.8)	8.2 (3.1)	33 (12)	2 (3)	80.1 (0.8)
2008	57	9.5 (3.0)	7.5 (2.3)	27 (11)	2 (4)	81.9 (0.7)
2009	100	16.7 (8.3)	13.5 (6.7)	19 (8)	1 (2)	86.0 (0.1)
2010	64	10.7 (3.1)	5.8 (1.7)	34 (14)	0	80.9 (0.7)
2011	82	13.7 (4.8)	11.5 (4.0)	20 (8)	0	83.2 (2.7)
2012	86	14.3 (8.4)	14.2 (8.4)	6 (4)	1 (2)	77.4 (0.5)
2013	129	25.8 (8.1)	25.4 (7.9)	21 (6)	1 (1)	85.5 (0.1)
2014	47	7.8 (3.5)	7.7 (3.3)	74 (11)	4 (5)	80.4 (1.1)

Table 6. Age, minimum, maximum and weighted mean lengths (mm) at capture by age (determined from otoliths) for walleye sampled in experimental gill nets in Shadehill Reservoir, Perkins County, South Dakota, August 13-15, 2012.

Age	Minimum length @ capture	Weighted mean length @ capture	Maximum length @ capture	Number of fish in survey
2	244	287	330	8
3	251	325	389	75
5	556	556	556	1

Table 7. Age, minimum, maximum and weighted mean lengths (mm) at capture by age (determined from otoliths) for walleye sampled in experimental gill nets in Shadehill Reservoir, Perkins County, South Dakota, 2013.

Age	Minimum length @ capture	Weighted mean length @ capture	Maximum length @ capture	Number of fish in survey
1	210	221	232	2
2	272	297	313	4
3	281	300	315	11
4	272	349	428	102
5	333	418	505	4
9	507	526	545	2

Table 8. Age, minimum, maximum and weighted mean lengths (mm) at capture by age (determined from otoliths) for walleye sampled in experimental gill nets in Shadehill Reservoir, Perkins County, South Dakota, August 18-20, 2014.

Age	Minimum length @ capture	Weighted mean length @ capture	Maximum length @ capture	Number of fish in survey
1	250	275	296	5
2	326	330	333	2
3	354	369	386	4
4	380	406	447	3
5	371	430	485	29
6	545	545	545	1
8	484	484	484	1
19	748	748	748	1

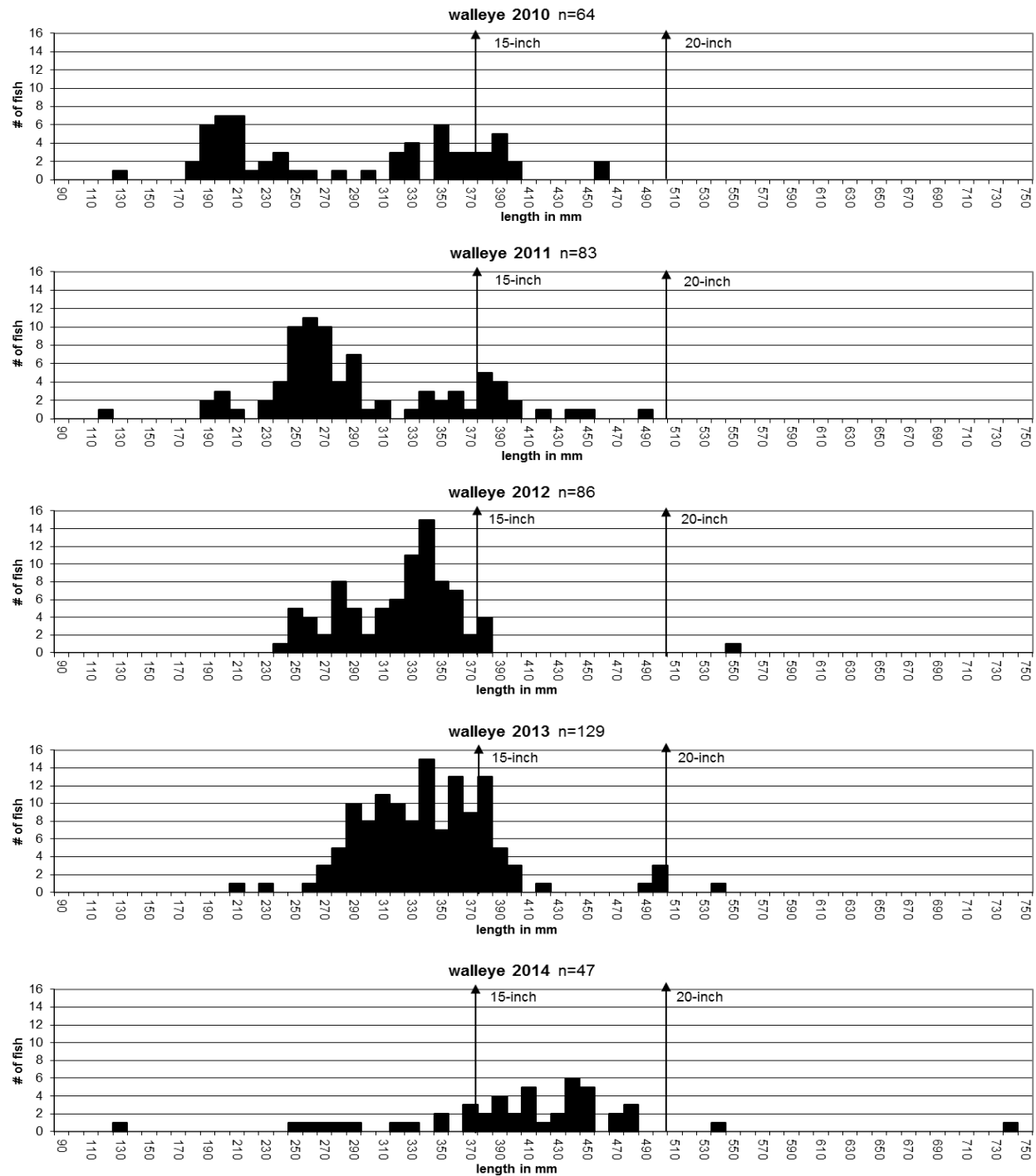


Figure 5. Length frequency histograms for walleye collected in experimental gill nets from Shadehill Reservoir, Perkins County, South Dakota, 2010-2014.

White bass

White bass catch increased from a gill net CPUE of 1.4 last year to 10.3 in this year's survey (Tables 2 and 9). Fish condition was 92.8, down from 103.9 last year. The lower condition is

possibly related to the apparent decrease in the forage density of age-0 gizzard shad this year. The length frequency histogram shows at least three year classes present in the lake at this time (Figure 6).

Table 9. Composite listing of data for white bass collected by gill nets in Shadehill Reservoir, Perkins County, 2006-2013. CPUE's with 80% confidence intervals in parentheses. PSD, PSD-P and $Wr>S$ with 90% confidence intervals in parentheses.

Year	N	CPUE	CPUE-S	PSD	PSD-P	$Wr>S$
2011	49	8.2 (5.1)	8.0 (5.1)	92 (7)	50 (12)	90.7 (0.7)
2012	4	0.7 (0.5)	0.7 (0.5)	--	--	85.5 (0.0)
2013	7	1.4 (1.1)	1.0 (1.2)	--	--	103.9 (3.9)
2014	62	10.3 (4.6)	9.8 (4.3)	58 (11)	44 (11)	92.8 (0.6)

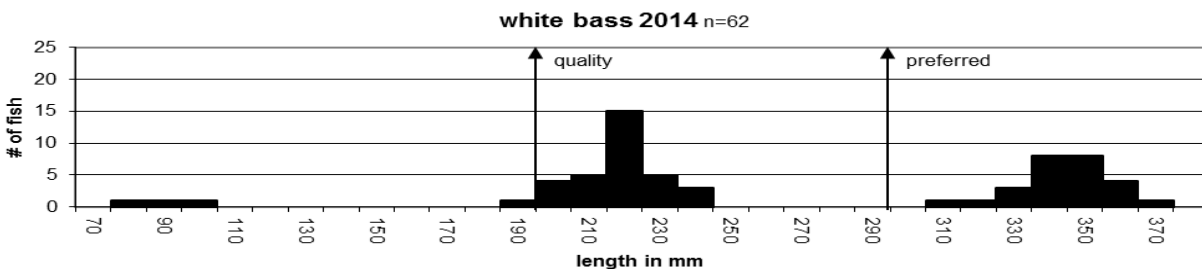


Figure 6. Length frequency histograms for white bass collected in experimental gill nets from Shadehill Reservoir, Perkins County, South Dakota, August 18-20, 2014.

White crappie

White crappie abundance was low this year, and is possibly attributed to the late sampling date. Only seventeen fish were sampled, compared to 446 last year (Tables 1 and 10). The length frequency shows no recent recruitment and a population dominated by large fish (Figure 7).

Table 10. Composite listing of data for white crappie collected by trap nets in Shadehill Reservoir, Perkins County 2011-2014. CPUE's with 80% confidence intervals in parentheses. PSD and PSD-P and Wr with 90% confidence intervals in parentheses.

Year	N	CPUE	PSD	PSD-P	$Wr>S$
2011	139	13.9 (9.4)	100	89 (5)	100.2 (0.7)
2012	33	4.1 (1.8)	100	91 (9)	103.4 (0.9)
2013	446	49.6 (39.8)	100	63 (4)	96.1 (1.6)
2014	17	1.7 (0.9)	100	100	96.4 (0.7)

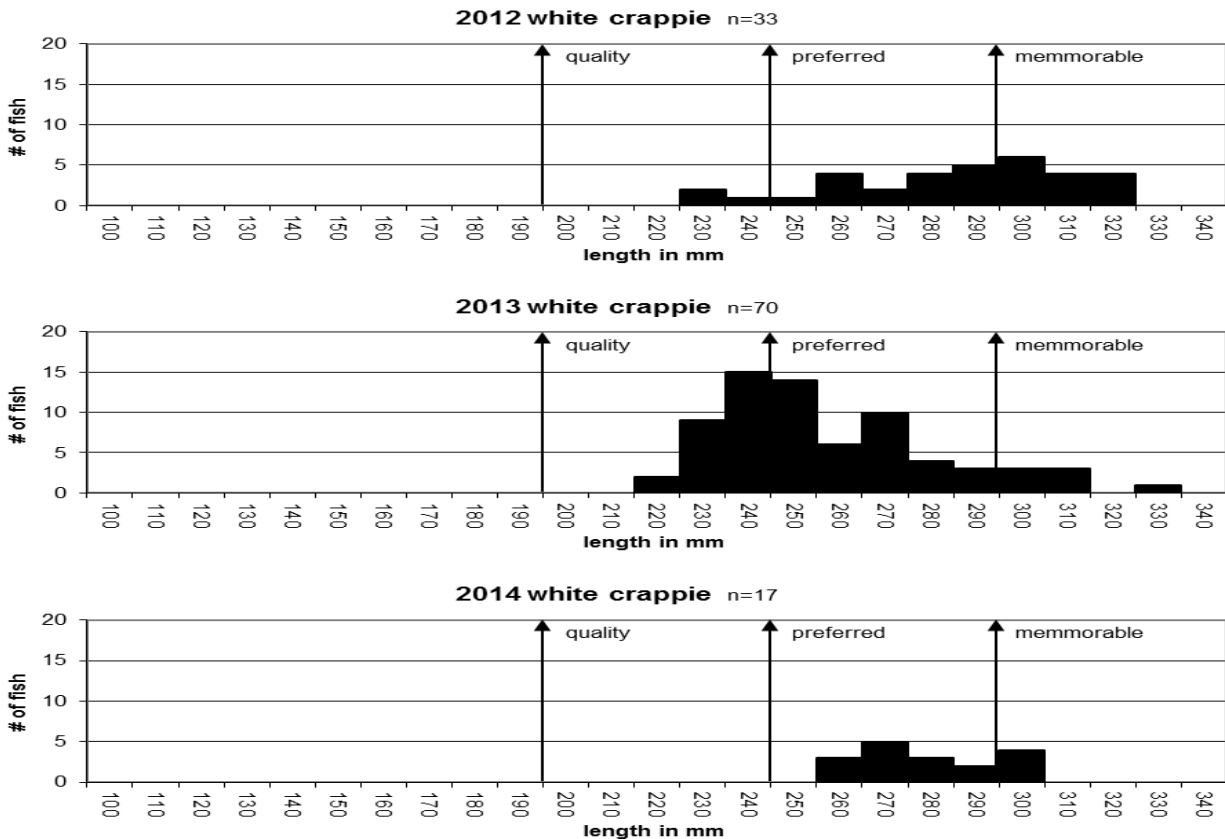


Figure 7. Length frequency histograms of white crappie collected by trap nets in Shadehill Reservoir, Perkins County, South Dakota, 2012-2014.

RECOMMENDATIONS

1. Continue conducting annual fish surveys to evaluate populations and stocking success (i.e. gizzard shad introductions, walleye, and smallmouth bass).
2. Stock adult pre-spawn gizzard shad annually to maintain high forage potential for walleye and other predatory fish.

APPENDIX

Appendix A. Stocking history including year, number stocked, species and size of stocking at Shadehill Reservoir, Perkins County, South Dakota, 2002-2014.

Year	Number	Species	Size
2002	50,000	walleye	Fingerlings
2003	251	gizzard shad	Adult
2004	233 162,700	gizzard shad walleye	Adult Fingerlings
2005	250 200,300	gizzard shad Walleye	Adult Fingerlings
2006	65 166,698	gizzard shad walleye	Adult Fingerlings
2007	192,953	walleye	Fingerlings
2008	409,235	walleye	Fingerlings
2009	420,652 85	walleye gizzard shad	Fingerlings Adult
2010	90 385,829	gizzard shad walleye	Adult Fingerlings
2011	225 278,922	gizzard shad walleye	Adult Fingerlings
2012	6,000,000 28,832 30,173	walleye rainbow trout smallmouth bass	Fry Fingerlings Fingerlings
2013	100 112,275	gizzard shad walleye	Adult Fingerlings
2014	5,000,000 373	walleye gizzard shad	Fry Adult